420 FAMILY
OF
ISOLATING SIGNAL CONDITIONERS

420i / 420V

C O N T E N T S

1.0 INTRODUCTION

The 420 i / 420 V is a family of input loop powered signal conditioners capable of accepting a wide variety of mA input ranges and providing an isolated voltage or current output.

The family comprises three basic models each with a standard configuration, custom variants being available to special order.

The different formats are as shown below. Input signal and output signal information are required to define any unit exactly. This information, together with a unique serial number, is printed on the side label of each unit; records of the exact configuration of every product shipped are maintained at the factory.

1.1 Members Of The Family

420 i

The basic 420 i provides 1 to 1 galvanic isolation of DC currents between 0 and 50 mA, covering the standard 0 - 20 mA and 4 - 20mA ranges as well as 0 - 1mA, 0 - 5mA and 0 - 10mA, with the accuracy specified in section 7. (2 to 1, 4 to 1, 1 to 2 and 1 to 4 ratios are also possible, although a minimum order quantity may apply in these cases). There are no adjustment potentiometers on the 420 i, accuracy being inherent in the circuit design.

The output signal is always proportional to the input signal - i.e. no offset can be added or subtracted.

The maximum loop resistance that can be driven by the 420 i and the maximum voltage drop of the 420 i itself are as follows:

Full Scale Input/mA	Max load resistance/Ω	Max voltage drop /V
1	12,000	2.0
5	2,500	2.5
10	1,300	3.0
20	650	3.5
50	200	6.5

420 i - 1

The basic 420 i - 1 provides a 5V DC output for a 20mA DC input, i.e. 0 - 20 mA at the input provides 0 - 5V output, 4 - 20mA input providing 1 - 5V output. Many variations are possible with the accuracy specified in section 7 provided that the following limits are observed:

Input Current Range		Output Voltage Range	
Min	Max	Min	Max
0 - 1mA	0 - 50mA	0 - 100mV	0 - 12V

There are no adjustment potentiometers on the 420 i - 1, accuracy being inherent in the circuit design. The output signal is always proportional to the input signal - i.e. no offsets can be added or subtracted.

The minimum input resistance that the output of the 420 i - 1 should look into, to avoid loading of the output, can be calculated as follows:

$$R_{in} \geq (V_{out} / I_{in})\ 1000$$

Where I in is the full scale input to the 420 i-1 in mA, V out is the full scale output in volts and R in is in KΩ.

e.g. Input= 4 - 20mA; output = 1 - 5V

R in ≥ 250 KΩ

420 V

The basic 420V can be reconfigured by the user to provide a 0 - 10V DC output for either a 4 - 20mA or a 0 - 20mA DC input. (Additionally a 2 - 10 V DC output with 4 - 20 mA input can be selected). Unless specified at point of order the default configuration (4 - 20mA in, 0 - 10V out) will be set.

A 0 - 5V or 1 - 5V reconfigurable version is also available by special request - contact factory for details.

Many variations are possible with the accuracy specified in section 7 provided that the following limits are observed:

Full Scale Input Current		**Minimum Span**	**Output Voltage Range**	
Min	Max		Min	Max
1mA	50mA	50% full scale	0 - 100mV	0 - 20V

The 420 V has zero and span potentiometers and allows offsets on the input signal to be removed (e.g. 4 - 20mA in, 0 - 10V out). Furthermore the full scale voltage drop from the input loop is usually less than the output voltage (e.g. at 10V output, input voltage drop from 20mA loop is typical 5V).

The minimum input resistance that the output of the 420V should look into, to avoid loading of the output can be calculated as follows:

$$R_{in} \geq (V_{out} / I_{span}) . 4000$$

Where I span is the difference between the full scale and minimum scale input to the 420V in mA, V out is the full scale output in volts and R in is in KΩ

e.g. Input = 4 - 20mA; $\Rightarrow$ I span = 16
Output = 0 - 10V

$R_{in} \geq 2{,}500\ K\Omega = 2.5M\Omega$

However since the span of the 420V is adjustable, loads up to 100 times smaller than this can be accommodated by individual calibration. e.g. in the above case a resistance as low as 25KΩ can be handled.

2.0 UNPACKING

Please inspect the instrument carefully for signs of shipping damage. The unit is packed to give maximum protection but we can not garantee that undue mishandling will not have damaged the instrument. In the case of this unlikely event, please contact your supplier immediately and retain the packing for our subsequent inspection.

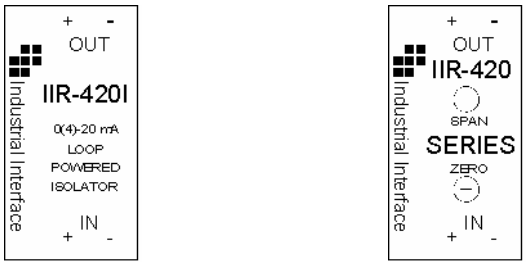
2.1 Checking the Unit Type

Each unit has a unique serial number label (fig. 1 below) on which full details of the configuration are given. These details should be checked to ensure conformance with your requirement.

Industrial Interface CE

PART NUMBER	420i
INPUT	0(4)-20mA
OUTPUT	0(4)-20mA
SUPPLY	LOOP
OPTIONS	
SERIAL No.	424-789

Fig. 1 - Serial Number Label



420i 420V

Fig. 2 - Front Panel Labels

3.0 CONNECTIONS

This section details the instrument connection information. Before proceeding, please check the information on the serial number label on one side of the unit to ensure that the unit configuration is correct. Connection details are given on the front panel label shown in fig. 2 above.

3.1 Inputs

Input current should not exceed 50mA; otherwise damage to the unit may result. The 420 i/420 V are unipolar devices - i.e. input and output do not respond to negative signals. However reverse polarity connection will not damage the unit provided the maximum current criterion is not exceeded.

IMPORTANT: Do not apply low impedance voltage signals to input or output otherwise damage will result. (e.g. 24V DC supply).

4.0 RECONFIGURING THE INSTRUMENT (applies to reconfigurable 420V units only)

In many cases the instrument will have been factory configured to the required specifications, and calibrated, in which case this section can be ignored.

If a particular configuration is not specified then the default (specified below) will be supplied.

4.1 Input Configuration

The section details the steps required to reconfigure the unit, after which recalibration will be necessary.

(If the configuration is not specified at the time of order the default configuration of 4 - 20mA input, 0 - 10V output will be set).

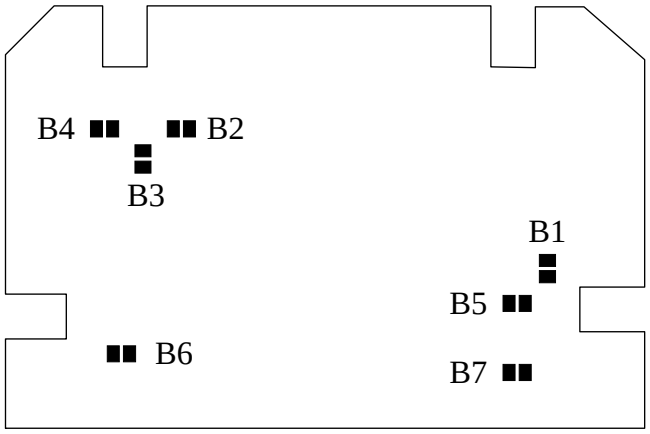


Fig.3 - Solder Bridge Link Selection Of Input Range

To reconfigure the instrument remove the side cover without the serial number label, from the unit - this cover is a push fit and can be prised off with a thumb nail or small screwdriver. The five links B1, B2, B5, B6,B7, should be open or short circuit according to the following table:

Input Range	Output Range	B1	B2	B5	B6	B7
0 - 20 mA	0 - 10 V	Open	Short	Short	Short	Short
4 - 20 mA	0 - 10 V	Short	Short	Short	Short	Open
4 - 20 mA	2 - 10 V	Open	Short	Short	Short	Short

WARNING: TAKE GREAT CARE NOT TO DAMAGE THE DELICATE COMPONENTS ADJACENT TO THE LINKS

B3 and B4 can be ignored
After reconfiguration replace the side cover.

5.0 RECALIBRATION

The 420 i and 420 i -1 units are not recalibratable but have their test data recorded at the factory. All 420 V units are factory calibrated; although the user may wish to recalibrate with greater frequency, a two yearly recalibration interval is adequate for most applications.

In the case of reconfigurable units, recalibration must be carried out after any change of configuration.

With appropriate input values use front panel zero and span pots to obtain desired zero scale and full scale voltage output (preferably with actual output circuit connected, for greatest accuracy). It may be necessary to repeat each adjustment to ensure correct calibration.

6.0 INSTALLATION

6.1 Installation onto Rails

The instrument is designed to mount directly onto either the 'Top hat' TS35 standard assembly rail to DIN 46277 part 3/EN 50022/BS5584, or the asymmetrical 32mm G-rail to DIN 46277 part 1/EN50035/BS5825.

6.2 Mounting Arrangements

Ideally the unit should be mounted in a vertical position, i.e. on a horizontal rail. This is the optimum orientation to minimise temperature rise within the unit. However successful operation is possible in any orientation.

Ensure the maximum ambient temperature is less than 70^{o}C.

Good airflow around the unit will maximise reliability.

6.3 Wiring Precautions

The unit can accept a variety of sensor inputs, some of which produce very small signals. Therefore it is advisable to adhere to the following rules of good installation practice.

(i) Do not install close to switchgear, electromagnetic starters, contactors, power units or motors.

(ii) Do not have power or control wiring in the same loom as sensor wires.

(iii) Use screened cable for sensor wiring with the screen earthed at one end only.

(iv) Take care not to allow cut pieces of wire to fall onto the unit as they might enter via the ventilation holes and cause eletrical short circuits. If in doubt, remove the units from the rail until wiring is complete.

(v) Use bootlace ferrules on all bare wires.

IMPORTANT: The connection terminals are designed for a maximum torque of 0.4Nm. Exceeding this figure is unnecessary and will result in unwarrantable damage to the unit.

7.0 SPECIFICATIONS

All specifications are at 20^{o}C operating ambient unless otherwise stated.

Accuracy and Response

420 i

Maximum output current error 0 - 20mA into 250 Ω	30µA
Linearity	+/- 0.1% full scale
Output current variation with load resistance, R_L (20mA input)	-200nA/ Ω max, $0 \leq R_L \leq 600\Omega$
Response Time (90% of step change)	30ms typical
Max Input Voltage drop (20mA input, $R_L = 0$)	3.5V
Temperature coefficient of output (20mA input)	90ppm / ^{o}C max

420 i -1

Maximum output voltage error (0 - 5 V into 1MΩ)	13mV
Linearity	+/- 0.1% full scale
Response Time (90% of step change)	30ms typical
Max Input Voltage drop (20mA input, 5V output)	8.5V
Temperature coefficient of output	90ppm / ^{O}C max

420 V

Calibration accuracy at zero and full scale (into 10MΩ)	+/- 0.05% full scale
Linearity	+/- 0.1% full scale
Zero drift	+/- 50ppm full scale /^{O}C
Gain drift	+/- 90ppm /^{O}C
Response time (90% of step change)	30ms typical
Max input voltage drop (20mA input, 10V output)	5.5V

Isolation and operating Ambient (all types)

Input to output isolation	1kV DC
Operating temperature range	-15 - 70^{O}C
Storage temperature range	-40 - 100^{O}C
Operating and storage humidity range	0 - 90% RH

7.1 EMC performance

The 420 i, 420 i -1 and 420 V all conform with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of member states relating to electromagnetic compatibility (Article 10 (1)):

1) Radiated Emissions:

The units meet EN55011: 1991 (Group 1,ClassB) and EN55022: 1987 (Class B)

2) EMC Immunity:

The units meet EN50082-2: 1995 as follows:

(i) ESD Immunity:

Performance is not degraded by 8KV ESD to ground in the vicinity of the units. Direct ESD greater than 4KV to the connection terminals or adjustment pots of the units should be avoided.

IMPORTANT: Service/ Maintenance personnel should take care to discharge themselves to the control cabinet/ systems earth before wiring, adjusting or calibrating the units.

(ii) RF Immunity:

The output of the units varies by less than +/- 0.5% full scale with fields of 10 Vm^{-1} with 80% A.M. at 1KHz, between 800KHz and 1GHz with any field orientation.

(iii) Fast Transient Immunity:

During transients of 2 KV the outputs vary by less than 0.5% full scale.

Hence the units are suitable for both ‘Light industrial’ and ‘Industrial’ environments.